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14. ABSTRACT

Prevention of combat-related PTSD is more important to the combat readiness of the military than the treatment of PTSD. Biological, psychological, and social pretrauma risk indicators and risk mechanisms can be identified to form policy decisions and to inform a PTSD prevention effort within the military to reduce future incidence of PTSD, reduce social and fiscal costs of PTSD, and preserve combat readiness. The small pool of soldiers in the current all-volunteer force virtually guarantee that any war fought in the next 20 years will rely heavily on soldiers who have experienced over 10 years of war and all the traumatic events that war entails. The risk of developing PTSD increases with each exposure to a traumatic event. Without more focus on PTSD prevention, the next war could see a large increase in PTSD, which could dramatically affect combat performance. Determining factors that may contribute to or protect from the development of PTSD could help develop measures/programs aimed at prevention. These factors are extremely complex because they involve interactions between pre-trauma characteristics/factors, peri-trauma characteristics/factors, and post-trauma characteristics/factors. Each of these sets of characteristics/factors has biological, psychological, and social components that could affect development of PTSD.

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PTSD: Prevention Focused

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EXECUTIVE SUMMARY

Title: PTSD: Prevention Focused

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Thesis: Prevention of combat-related PTSD is more important to the combat readiness of the military than the treatment of PTSD. Biological, psychological, and social pretrauma risk indicators and risk mechanisms can be identified to form policy decisions and to inform a PTSD prevention effort within the military to reduce future incidence of PTSD, reduce social and fiscal costs of PTSD, and preserve combat readiness.

Discussion: As demonstrated through early writings, the symptoms of PTSD have been evident in every large-scale conflict to some degree. Most recently, it is estimated that one in five Soldiers or Marines who have served in Iraq or Afghanistan have suffered from PTSD. Justifiably, a lot of focus has been given to the 1 out of the 5 that developed PTSD, but what about the 4 that did not? What factors protected them? Given that combat and war have persisted throughout human history, and there is no reason to believe the future will be any different, it is highly likely that more wars will be fought and more soldiers will develop the symptoms of PTSD if nothing changes regarding PTSD prevention. The small pool of soldiers in the current all-volunteer force virtually guarantee that any war fought in the next 20 years will rely heavily on soldiers who have experienced over 10 years of war and all the traumatic events that war entails. The risk of developing PTSD increases with each exposure to a traumatic event. Without more focus on PTSD prevention, the next war could see a large increase in PTSD, which could dramatically affect combat performance. Determining factors that may contribute to or protect from the development of PTSD could help develop measures/programs aimed at prevention. These factors are extremely complex because they involve interactions between pre-trauma characteristics/factors, peri-trauma characteristics/factors, and post-trauma characteristics/factors. Each of these sets of characteristics/factors has biological, psychological, and social components that could affect development of PTSD.

Conclusion: PTSD prevention is extremely important to the military. The current state of research has not advanced the knowledge base appropriately towards a preventative paradigm shift in the military. Identification of pretrauma risk indicators and risk mechanisms can help policy makers make informed decisions regarding employment of soldiers and can help form the baseline for a comprehensive PTSD prevention program.

DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

Illustrations

Page

Tables

Page

Table of Contents

Page

Preface

The idea for this paper grew from witnessing the effects of more than ten years of war and war related PTSD on soldiers and on the combat readiness of the Army. In 2008, I learned about a "new" brand of psychology called Positive Psychology, which focused not on a medical model of treating illness, but instead focused on increasing wellness. At first, the idea sounds a little touchy-feely and hokey, but the idea that psychology can help people become happier is intriguing. This paper extends the idea of Positive Psychology to combat-related PTSD in order to build resilience.

This topic and the existing resilience-building programs in the military need more study and consideration to maximize program effectiveness and minimize future impacts of traumatic events.

I would like to acknowledge the guidance and mentorship of my faculty advisor, Dr. Pauletta Otis. Her advice and efforts are greatly appreciated. While I have never corresponded with him, Dr. Martin Seligman's writings helped shape my thoughts on what is possible. Dr. Seligman is the Director of the Positive Psychology Center at the University of Pennsylvania and founder of positive psychology.

INTRODUCTION

Prevention of combat-related posttraumatic stress disorder (PTSD) is more important to the future combat readiness of the military than treating those who suffer from PTSD. PTSD is an extremely debilitating injury that dramatically affects combat performance, and has enormous social and fiscal costs. While treatment of those suffering from PTSD is extremely important, a paradigm shift towards prevention of combat-related PTSD will help maintain combat effectiveness in the next war, and reduce the number of veterans who suffer a new onset of PTSD, which will reduce the social and fiscal impact of PTSD.

Combat is one of the most stressing environments that any person can be exposed to. In combat, soldiers are often exposed to numerous and frequent traumatic events. Most of the soldiers in the military have served multiple combat tours and have been exposed to untold traumatic events. This is dangerous for military readiness because the risk of developing PTSD increases with each traumatic experience.

Any conflicts in the next 20 years are likely to be fought with the same small, all-volunteer force that has experienced multiple traumas during more than 10 years of war. The cumulative effect of new traumatic events could easily cause PTSD rates to go to such levels that the financial, social, and military readiness costs are unacceptable. This risk can be mitigated through a paradigm shift towards prevention of PTSD. Biological, psychological, and social pretrauma risk indicators and protective factors for PTSD can be used to form policy decisions and to inform PTSD prevention efforts within the military to reduce the number who will suffer from PTSD and improve combat effectiveness in future conflicts.

Background

PTSD is a maladaptive condition that may develop after a person has experienced a traumatic event. PTSD is a debilitating injury that greatly affects the quality of life of its victims. The symptoms of PTSD can include recurrent recollections of the traumatic event, flashbacks, poor concentration, insomnia, depression, and intense fear. People with PTSD are 60 times more likely to have marital difficulties, 150 times more likely to be unemployed, more likely to perpetrate spousal abuse, more likely to suffer from poorer physical health, and are more likely to be alcoholic.[1,2,3] Comorbidity with other psychiatric conditions such as depression, mood disorder, anxiety disorder, and substance abuse disorder is between 79%-88% for those with PTSD.[4] Additionally and most disturbingly, people with PTSD are six times more likely than contemporaries to attempt suicide; in fact, PTSD has a stronger correlation to suicide than any other anxiety disorder.[5]

In the current American Psychiatric Association (APA) Diagnostics and Statistical Manual of Mental Disorders (DSM-IV-TR), PTSD is considered a type of anxiety disorder, but in the fifth revision (DSM-V), scheduled to be released in May 2013, PTSD will move into a new class of trauma and stressor-related disorders. The importance of this reclassification shifts the paradigm of the development of PTSD from character flaw causation to an event-driven causation. This shift in causation attribution could encourage abandonment of the position that only weak-minded people develop PTSD and ensure those in need of treatment can seek appropriate treatment without character-based implications.

PTSD affects from 4% to 6% of the general population as a result of relatively common traumatic events. About 60% of men and 50% of women have been or will be exposed to a potentially traumatic event (PTE) during their lifetime, and 50% of those will be exposed to multiple PTEs.[6] Those statistics show that the majority of people who encounter PTEs in the general population will process those events appropriately and will not develop symptoms of PTSD. Comparatively, combat is one of the most intense stressors that an individual can experience;[7] it kills and maims not just by destroying bodies, but by destroying minds as well.[8] For comparison, it is estimated that 20% of firefighters, 25% of victims of violent crime and rape, 50% of POWs, 60% of survivors of catastrophic natural disasters, and 65% of soldiers in heavy combat will develop PTSD.[9] Combat drastically increases the chances of experiencing PTEs, often without time between traumatic events to process the previous trauma effectively.[10] It is estimated that at any given time, 30% of men in combat zones have PTSD. By the time redeployment occurs, the estimated incidence rate of PTSD is around 12% and one year after deployment the incidence rate is around 16%.[11,12,13]

According to the current DSM-IV-TR, in order to meet diagnostic criteria for PTSD, a person must be exposed to an event that involves actual or threatened death or serious injury to oneself, or others, and: the person's response involves intense fear, helplessness or horror; the event is persistently re-experienced; stimuli associated with the traumatic event is avoided; persistent symptoms of increased arousal are present; duration of symptoms is longer than one month; and there is significant distress or impairment.[14] This paper focuses specifically on PTSD, which is diagnosed only after symptoms have persisted for more than 30 days after exposure to a PTE. Several other

disorders are closely related to PTSD, including Traumatic Brain Injury (TBI) from a concussive event such as an explosion, Acute Stress Reaction (ASR), and Combat Operational Stress Reaction (COSR). TBI and PTSD are often co-morbid and may stem from the same traumatic event; and ASR and COSR are transient disorders that generally do not require long-term psychiatric care.[15]

Among the maladaptive symptoms of PTSD are paralyzing fear of death, withdrawal, physical and emotional numbness, severe depression, and impaired combat functioning.[16] In a nation that relies on a relatively small, all-volunteer military force for defense and security, the effects of combat-related PTSD on readiness and military resources are alarming. If, as some have estimated, between 30%-47% of soldiers in combat are dealing with the symptoms of PTSD, military missions could be placed in serious jeopardy.[17]

Additionally, the strain on resources for both the military and the nation is enormous. Between 2001 and 2011, approximately 2.3 million U.S. military personnel served in Operation Iraqi Freedom (OIF), Operation Enduring Freedom (OEF), and Operation New Dawn (OND) with many service members having served multiple tours of duty.[18] The healthcare costs alone of these wars have been estimated by the Veterans Administration between $589 billion and $984 billion, and they likely have not peaked yet in 2013.[19]

Considering that only a small percentage of those who experience a traumatic event develop persistent symptoms of PTSD, protective or risk factors must exist that account for the different outcomes. Therefore, effective treatment of combat related PTSD is critical for the short-term health of the Armed Services and for the health of the

nation, but persistent PTSD prevention efforts should take priority in importance and resource allocation.

HISTORY OF COMBAT PTSD

The symptoms that are known today as PTSD have been a part of war for thousands of years, and examples can been seen in writings throughout history. Hori, an ancient Egyptian Prince wrote about fear of injury and death going into battle over 3,000 years ago: “Shuddering seizes you, the hair of your head stands on end, your soul lies in your hand.”[20] Herodotus wrote that at the battle for the pass of Thermopylae, two soldiers were seen by the surgeon for suffering an “acute inflammation of the eyes,” which happened to coincide with the beginning of battle. One of those soldiers, Aristodemus, “finding his heart failed him,” did not join the fight. He hanged himself after the battle.[21]

We can conclude that the symptoms of PTSD have not changed throughout the ages, but the way psychologists, soldiers, commanders, and the public think about and diagnose those symptoms has changed dramatically.

In the 18th and 19th Century, the term “nostalgia,” was coined as a psychiatric reaction to stress and fatigue.[22] In the 1860s and 1870’s, the symptoms of PTSD were known by a variety of names including “nostalgia,” “spinal concussion,” “railway spines,” “irritable heart,” “soldier’s heart,” “cardiac weakness,” and “Da Costa’s Syndrome.”[23] In the US Civil War, nearly 6% of the Union Army was discharged for “nervous diseases.”[24] During the 1880, the terms “traumatic shock” and “psychical trauma” had made it into psychiatric lexicon to explain all types of trauma related

psychological injuries; by 1910, “traumatic neurosis,” “shell shock,” “disordered action of the heart,” and “war psychoneurosis” became prevalent diagnostic terms.

In World War I, medical professionals began to observe behaviors such as debilitating shakes, tics and tremors, and stutters. During this period, this behavior was initially diagnosed with the term “hysteria,” but hysteria was previously associated solely with women, so the military coined the term, “shell shock” to differentiate male combat soldier trauma symptoms from hysteria.[25]

During World War II, psychiatrists were assigned to each division to treat soldiers with trauma symptoms. Dr. John Appel, the Chief of Preventative Psychiatry of the Surgeon General’s Office, examined the length of time a soldier could be in a combat zone and concluded that between 200 to 240 days in a combat zone would do psychological damage on even the strongest soldier. He stated, “There is no such thing as getting used to combat… Each moment of combat imposes a strain so great that men will break down in direct relation to the intensity and duration of their exposure. Thus, psychiatric casualties are as inevitable as gunshot and shrapnel wounds in warfare.”[26]

The realization that every man had a breaking point was important in the study and treatment of the symptoms of PTSD. The symptoms of PTSD were no longer only the realm of the weak; they could affect anyone in a given situation. PTSD was moved from a character fault to a naturally occurring reaction to extreme trauma. During World War II, it is estimated that 23% of the battlefield evacuations were for psychiatric reasons, and that somewhere between 2.8% to 10.1% of the 16.1 million U.S. troops who served in WWII were psychiatric-related casualties.[27,28]

During the Korean War, the U.S. military instituted a three-echelon system of treatment for psychological wounds. In the forward echelon, two psychiatrists and two clinical psychologists were assigned at the division level of each unit in Korea to treat psychological casualties near the front. These providers were able to return 50% to 70% of patients back to combat.[29] The second echelon consisted of the psychiatric services located at the hospitals in the Korean Theater, and the third echelon consisted of psychiatric services located in Japan or the United States. Few of those evacuated from theater were returned to duty in Korea.[30,31] Of the 5.7 million U.S. troops that served in Korea, it is estimated that 3.7% suffered psychiatric-related casualties.[32,33]

During the Vietnam War, PTSD gained a lot of attention. In Vietnam, there was no clearly defined front line, the enemy was not easily distinguishable from the local population, and the war was unpopular in the United States. Vietnam veterans had few ways of reconciling the combat trauma they had experienced and very little social support to lean on. This led to symptoms such as depression, flashbacks, suicidal and homicidal behaviors, and heightened startle responses. Neither the psychiatric community nor the American public had any way to reconcile these symptoms.[34] The Vietnam War ended with the fall of Saigon in 1975, and it was not until 1980 that the APA designated PTSD as its own diagnostic category in the Diagnostics and Statistical Manual version III (DSM III). The National Vietnam Veterans Readjustment Study (NVVRS) assessed PTSD among other mental health issues and found that between 27% and 31% of Vietnam veterans developed PTSD at some time in their lives.[35]

Subsequent conflicts in Grenada, Panama, and the Gulf War have had significant effects on the psychological well being of the veterans who participated as well.

According to one longitudinal study, approximately 15.2% of veterans of the Gulf War developed PTSD.[36] Peacekeeping operations, however, have had a much lower PTSD prevalence rate between 1% and 8% developing PTSD.[37]

The most recent U.S. combat operations, OEF, OIF, and OND have also had significant impacts on the psychological health of U.S. combat soldiers. Approximately 2.3 million deployments have occurred in support of OEF, OIF, or OND since 2001.[38] More than half of all service members have deployed multiple times in support of these operations.[39] As of October 2012 the Armed Services have diagnosed 104,703 service members with PTSD.[40] This statistic does not give the full scope of the problem; those numbers only include personnel that have been diagnosed while still in the military and do not include those who no longer serve. In a 2004 study, researchers found overall PTSD prevalence in OIF/OEF veterans ranged from 11.5% to 19.9%; of these only 23% to 40% sought treatment.[41]

The condition, now known as PTSD, has not changed over the years, but several important changes have occurred on the understanding of the condition, including causation and treatment.

SCOPE OF COMBAT RELATED PTSD

PTSD is not a universal response to exposure to a PTE. For most people, a traumatic event causes a physical, mental, and emotional reaction that will naturally peak and return to baseline or near baseline functioning within approximately three months, and only a small percentage will develop PTSD.[42] While estimates vary greatly on the percentage of those exposed to a PTE who develop PTSD, on the high end of the

spectrum, a Detroit study found that in civilian life, 23.6% of people exposed to a serious vehicle accident developed PTSD.[43] The Detroit study results will be used in the following table to highlight the possible impact and occurrence of PTSD in combat. Prolonged combat is much more strenuous than an isolated, normal PTE, if such a thing exists. Soldiers in combat are exposed to multiple PTE, often without time in-between events to normalize their reactions. The table below describes a sample of data on traumatic event exposure from a 2004 study of 894 soldiers who had recently been deployed to OIF/OEF.[44] The data listed below is limited to PTE experienced by 80% or more of the sample, but should sufficiently illuminate the scope of potential PTSD from combat exposure. Overlaid on the table is the prediction rate of PTSD by PTE exposure based on the Detroit study finding of 23.6% PTSD development after exposure to a single PTE.

PTE	% Exposed	Number Exposed (N=894)	Notional Average of PTSD developed from exposure to PTE (23.6% of # exposed)[45]
Seeing Dead Bodies / Remains	95%	849	200
Being Shot at / receiving small arms fire	93%	831	196
Being Attacked / Ambushed	86%	769	181
Knowing someone killed / seriously injured	86%	769	181
Clearing / Searching Homes	80%	715	169
Totals		3933	927

Table 1: Traumatic Event Exposure from 2004 Hoge et al. study

For example, from the above table, 95% of the 894 soldiers (849 soldiers) in the study experienced the PTE of seeing dead bodies and physical remains. Of those 849 soldiers, the prediction figure from the Detroit study, 23.6%, would mean that 200

soldiers would develop PTSD in response to this one event. Of the 894 total soldiers in the study, 80% or more had witnessed at least five separate PTE, and some had likely witnessed the PTE multiple times. The implication is that there is a very large probability that a soldier in combat will develop PTSD. Interestingly, the PTSD rate for soldiers returning from OIF/OEF/OND is only 11.5% -19.9%, which would equal between 103 to 178 soldiers for this particular group.[46] The predicted number of PTSD cases for the same group, based on 23.6% PTSD prediction rate, would be 211 soldiers. In the Hoge et al. study, 80% or more of the soldiers deployed had experienced one or more and potentially all of the PTE listed, which may or may not represent the average combat experience.

In a larger study of trauma exposure, RAND found trauma exposure rates as follows: [47]

PTE	% Exposed	Number Exposed (N=1965)	Notional Average of PTSD developed from exposure to PTE (23.6% of # exposed)[48]
Having a Friend Wounded/Killed	49.6%	974	230
Seeing dead or seriously injured	45.2%	888	210
Witnessing accident resulting in injury/death	45%	884	209
Smelling decomposing bodies	37%	727	172
Being physically moved/knocked by explosion	22.9%	450	106
Being injured, not requiring hospitalization	22.8%	448	106
Totals		4,371	1,033

Table 2: Traumatic Event Exposure from 2008 RAND study

This study shows much less prevalence of exposure to PTE, but even at the reduced likelihood of exposure rates, the conclusion remains the same: combat exposes individuals to multiple PTEs in a short period and increases the likelihood of developing

PTSD.

Combat-related PTSD has a long history from the beginning of warfare to the present. Changes in diagnosis, description, and treatment have resulted in a growing efficacy of evidence-based treatments for those who suffer from PTSD. The majority of research on PTSD has been focused on reducing the impact of the symptoms of PTSD, but not a lot of effort has been placed on prevention of combat-related PTSD. It is understood that combat is the most stressing life-event a person can experience; the majority of people in combat do not develop PTSD after a single exposure to a PTE; but the risk of PTSD increases with each exposure to traumatic events. Any potential conflict in the next 20 years will be likely be fought with the same small, all-volunteer force that has experienced multiple traumas during more than 10 years of war. Biological psychological and social pretrauma risk indicators and risk mechanisms can be identified to form policy decisions and to inform a PTSD prevention effort within the military.

PTSD PREVENTION

Determining protective and risk factors for PTSD is a difficult task. PTSD occurs in response to a traumatic event. This traumatic event is interpreted by the individual who observes or experiences the event, and the event is filtered through the context by which that person views the world. During this current conflict, an enormous amount of research has been conducted on PTSD. Evidence based treatments have been instituted, and several potential risk factors and potential protective factors have been identified.

Because PTSD is a maladaptive response to a potentially traumatizing event, these factors generally can be broken down into three logical characteristic groups:

pretrauma, peritrauma, and posttrauma. Pretrauma characteristics focus on previous trauma exposure, brain functioning, hereditary, medical health, age, IQ, morals, and more. Peritrauma characteristics focus on the characteristics surrounding and immediately following a PTE, such as the type of traumatic event (explosion, killing enemy soldier, car accident, natural disaster, etc.), severity of the event, internal biochemical reactions, and thoughts/emotions surrounding the event. Posttrauma characteristics include biochemical reactions, social support (family and unit), substance abuse, new stressors, and availability and efficacy of psychological care. Understanding that combat is one of the most stressful life events with a greater exposure to PTEs than nearly any other situation, interventions must be created that address all three sets of characteristics where possible. This paper will focus on pretrauma risk factors to help prevent development of PTSD.

Most research on PTSD risk factors and protective factors are conducted under the global "risk factor" umbrella.[49] For this paper, risk factors will be broken into two areas: risk indicators (variables that indicate a risk for developing PTSD) and risk mechanisms (variables that may lend themselves to methods of PTSD prevention).[50] Generally speaking, risk indicators could be useful for making policy decisions, and PTSD prevention initiatives can be built around risk mechanisms.

In examining pretrauma risk indicators and mechanisms, this paper will identify biological, social, and psychological attributes that are potentially linked to development of PTSD. The diagram below illustrates the conceptual organization model this paper follows.

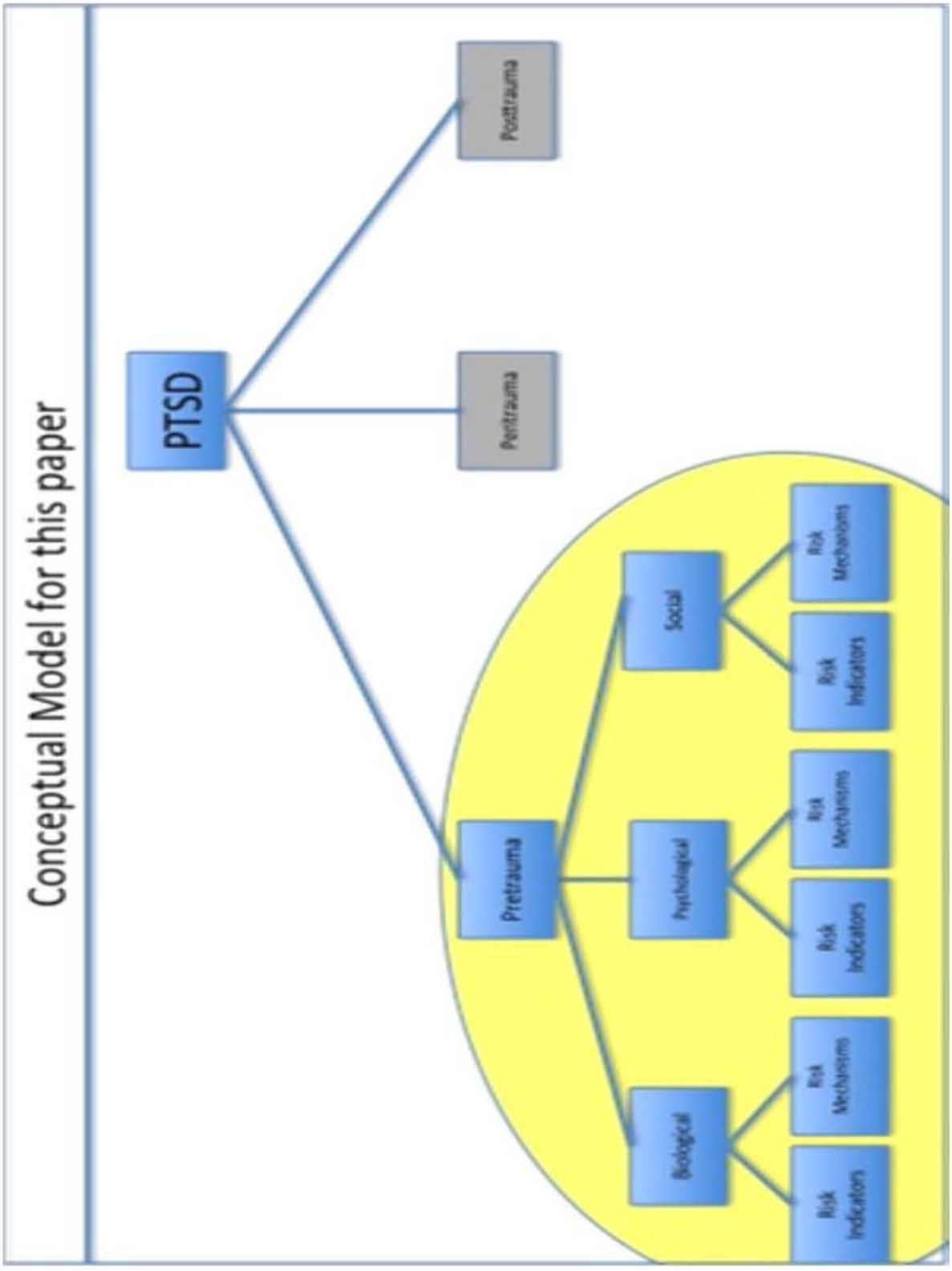

Figure 1: Conceptual Model

Biological Pretrauma PTSD Risk Factors

Biological factors have been found in many studies to contribute to or predict the development of PTSD. Current literature suggests that biological pretrauma risk indicators include gender, heredity, age and intelligence, and biological pretrauma risk mechanisms include biochemical functioning and medical health.

Biological Pretrauma PTSD Risk Indicators

The first pretrauma biological risk indicator for PTSD may come in the genetic history of an individual. In a 1993 twin study, researchers found that approximately 30% of variance in PTSD symptoms is caused by genetics.[51] The findings of the 1993 study were closely mirrored in a subsequent study in 2002.[52] Several later twin studies have suggested that between 30-70% of PTSD risk is genetic.[53,54,55,56] Researchers are getting closer and closer to finding a link between genetics and PTSD. Most recently in 2012, a group of researchers found the first positive association from a genome wide scan for genetic risk factors for PTSD between PTSD and the Retinoic Acid Orphan Receptor A (RORA) gene.[57] Previous studies have associated RORA as a risk factor for attention-deficit hyperactivity disorder, bipolar disorder, and autism.[58,59] It is clear from these findings that additional research needs to be conducted on the RORA gene and other biological indicators in order to better understand how they interact with the biopsychosocial environment in the development or protection of PTSD.

Age at exposure to trauma is a biological pretrauma risk indicator as well. Elder and Clipp (1989) found that men who entered the military at an earlier age were

especially susceptible to combat related PTSD.[60,61] Subsequent studies narrowed down the age group at the greatest risk for PTSD to 18 to 24 year olds.[62] A 2006 study postulates that younger soldiers may not have developed the appropriate level of coping strategies required to deal with combat trauma.[63] It would be interesting to see research on the number of traumatic events soldiers are exposed to by age in order to rule out the possibility that age is a risk factor due to job/position; generally in the military, the older you are, the more rank you are likely to have, and with rank generally comes less front-line combat exposure. If age is a pretraumatic risk factor because of inadequate coping strategies, as the 2006 study postulates, then age itself is not a risk indicator; rather inadequate coping strategies would be considered a pretraumatic risk mechanism that can be targeted by prevention programs.

If the 2006 study is not correct and age itself is a risk factor, policy makers might be able to factor in the age of military forces prior to assigning combat duties. This major paradigm shift might be unacceptable to decision makers, but at least a cost-benefit analysis would be completed and the U.S. would enter combat with an understanding of possible psychological consequences.

The next pretrauma biological risk indicator for PTSD is gender. Simply being female may increase the risk of developing PTSD by more than 2.38 times from exposure to the same PTE as a male.[64,65,66,67] The reason for increased likelihood for development of PTSD for females has been attributed to a greater lifetime exposure rate among females to specific kinds of traumatic events such as sexual assault, but as in any under-researched field, contradictions arise. Data from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) does not support the theory that greater

lifetime exposure of females to certain types of violence increases PTSD. When exposed to the same traumatic event of sexual assault, 17.1% of males developed PTSD compared to 43.2% of females. The following table details data from the NESARC. [68,69]

Event type	Ever exposed[a]	Index event[b]	PTSD	(%)[c]
Total				
Sexual assault	3328	1054	440	(40.2)
Severe accident	5552	782	84	(9.6)
Natural disaster	5416	582	24	(5.1)
Unexpected death	14 179	7151	721	(9.0)
Males				
Sexual assault	428	105	22	(17.1)
Severe accident	3159	492	37	(6.4)
Natural disaster	2662	276	10	(3.5)
Unexpected death	5911	2894	181	(5.3)
Females				
Sexual assault	2900	949	418	(43.2)
Severe accident	2393	290	47	(16.0)
Natural disaster	2754	306	14	(6.9)
Unexpected death	8268	4257	540	(12.3)

PTSD, Post-traumatic stress disorder; NESARC, National Epidemiologic Survey on Alcohol and Related Conditions.

[a] Respondents who experienced more than one of these events appear in multiple categories.

[b] The index event was the worst event for respondents with ⩾2 events or the event reported by respondents with only one event. [c] χ^2 (overall) = 214, $p \leqslant 0.001$; χ^2 (males) = 7.3, $p \leqslant 0.001$; χ^2 (females) = 130, $p \leqslant 0.001$.

Figure 2: National Epidemiologic Survey on Alcohol and Related Conditions

Until very recently women were excluded from ground combat positions; however, recent changes in the U.S. Military role of women in combat have led to a greater saturation of females on the battlefield. As of January 2013, more than 1,110 women have been killed or wounded in action in OIF/OEF/OND.[70] Among OIF/OEF veterans, 45% of women and 50% of men reported experiencing combat exposure.[71]

Studies vary greatly regarding the prevalence of PTSD in females in combat with extremes claiming a 2.38 times greater prevalence in females to no difference in prevalence between males and females.[72] For example, a 2011 study concluded that gender differences are negligible on the impact of combat-related stressors on mental health and development of PTSD.[73] In summary, it remains unclear whether gender makes a difference in development of PTSD for combat soldiers. If gender is found to be a significant risk indicator, the recent policy decision allowing women in combat roles may require careful deliberation from policy-makers. More research is required to facilitate a better understanding of the full implications of females in combat.

Intelligence or Intelligence Quotient (IQ) is the final pretraumatic biological risk indicator. IQ has been shown to predict BMI, blood pressure, risk for depression, and development of PTSD.[74] The IQ score is thought to be a way to measure the intelligence of individuals. IQ scores have been found to be relatively stable over time and predict education accomplishments, economic accomplishments, morbidity, and mortality.[75] The mechanism for IQ impacting development of PTSD is not exactly known. It could hinge on mental processing abilities, reasoning abilities, or on social factors identified with more intelligent people such as more cerebral employment environments. Intelligence and IQ are different than education. Education is a risk mechanism and can be targeted for remediation. Intelligence or IQ is a risk indicator that can signal susceptibility for future development of PTSD. IQ testing could help identify and target populations of the military at greater risk for development of PTSD.

Biological Pretrauma PTSD Risk Mechanisms

The first potential risk mechanism for PTSD is biochemical functioning. Essentially, this category is concerned with how the brain functions. There is evidence that there is a neurobiological connection in patients with chronic PTSD. Specifically, the amygdala, the hippocampus, and the neurotransmitters noradrenaline, dopamine, opioids, and serotonin, are suspected to be involved in PTSD development.[76] Trauma seems to rest in the brain's noradrenaline system, making people prone to adrenaline surges after the traumatic event.[77] In one study it was found that PTSD sufferers had abnormally high levels of adrenaline and noradrenaline in their bodies. In another study, PTSD sufferers were found to have 40% less alpha-2 receptors. As Daniel Goleman states, "In other words, researchers found a series of neurobiological changes that left PTSD sufferers with an altered brain metabolism – vulnerable to surges of noradrenaline – thus prompting the alarm states."[78]

Recently, the amygdala's role in PTSD has been explored more fully. The amygdala is a key site for regulation of serotonin (5HT), which has been linked to PTSD. The amygdala is a key brain structure in processing fear related memories and for coordinating fear related behaviors. PTSD may be related to hyperactivity of the amygdala in response to threatening stimuli.[79]

Few studies have been conducted to determine if these biochemical changes are pretraumatic risk factors or if a traumatic event induces them, but a biological marker may exist which would predispose a group of people to maladaptive responses to traumatic events. In an effort to determine possible pretrauma markers, a 2005 study examined Firefighters over a 2-Year period. Neuroendocrine activity was assessed at the beginning of the study using cortisol tests to establish pretrauma baseline levels and again

upon the conclusion of the study. The results were correlated with the development of PTSD and were found not to be predictive.[80] While this study was unable to find a connection between cortisol and development of PTSD, another study suggests that a pretrauma marker does exist.

In 2009, researchers examined the startle response of police academy cadets prior to exposure to PTE. After one year of exposure to police-related trauma, participants were screened for PTSD symptoms, and it was it was found that more severe PTSD symptoms were associated with pretrauma startle response.[81] The discovery of biological markers will allow a much more complete understanding of the development of PTSD and might allow for development of intervention techniques, such as pharmacotherapy, aimed at combating new onset PTSD.

Medical health is another important risk mechanism to examine for a comprehensive approach for PTSD prevention programs. A 2008 study examined health records of soldiers with combat related PTSD. They found that soldiers with pre-deployment health record scores in the bottom 15% were two to three times more likely to develop symptoms of PTSD. Soldiers who scored the lowest in both mental health and physical health were over three times more likely to develop PTSD.[82] This data suggests that a recurring screening of physical and mental health could be accomplished in order to target a population of low-scorers for improvement/intervention, or for screening criteria for combat duty.

Social Pretrauma PTSD Risk Factors

The next pretrauma risk factor category is related to the social domain. Pretrauma risk indicators in the social domain include rank, popular opinion, and war support writ-large. Pretrauma risk mechanisms in the social domain include family support, military support, education, spirituality, and morality.

Social Pretrauma PTSD Risk Indicators

Having higher rank in the military is inversely related to PTSD development.[83] In a study of World War II Prisoners of War, rank and education levels were inversely related to PTSD symptoms.[84] More recently, a 2007 study found that higher rank was associated with fewer PTSD symptoms.[85] As discussed earlier regarding age, those with higher rank may have developed better coping mechanisms, or due to their rank, they may be less likely to be on the front line of combat. Whatever the explanation, rank is a risk indicator that cannot be manipulated to prevent PTSD. At best, it can be used to target peritrauma and posttrauma intervention efforts.

Popular Opinion and war support writ-large are additional pretrauma social factor risk indicators that must be considered. Not much is known about the linkage between societal support for a pending or ongoing combat situation and development of PTSD. Due to the benefits of social support following trauma exposure for those with PTSD, it is not unreasonable to believe that an inverse relationship exists between popular support for a war and development of PTSD. A soldier who deploys to combat to the sound of cheers and a grateful nation will have a much better outlook on future sacrifices than the soldier who deploys to sound of protests. Popular social support likely infects everything, from familial social interactions to social standing in the community. Popular support for

a war is too important to not have a relationship with PTSD. Policy makers should be aware that there may be a connection between support for a war and PTSD to ensure any war is worth the cost.

Social Pretrauma PTSD Risk Mechanism

The social domain pretrauma risk mechanism of family support is important in the development of PTSD. Family instability has been associated with development of PTSD.[86] Concerns over family stability while deployed could reduce soldier's coping capacity, opening the door for negative reactions to PTE.[87] Positive family support may increase resilience by increasing the sense of social support available.[88] Soldiers with greater family support are more likely to believe that they can weather the most strenuous circumstances with the help of their family and friends. Some amount of family support can be cultivated in the military to help reduce anxiety and build constructive outlets for problem sharing. These programs should be incorporated in any PTSD prevention program.

The military is a unique organization with different mechanics than society. Military members change duty stations approximately every three years, and they are not likely to be co-located with extended family to help provide family social support. The military has designed systems to help facilitate a sense of social support. These programs can be broken in many categories, but they generally center on the soldier and on the family.

Military support for the soldier centers on small unit dynamics and phrases like unit cohesion, morale, esprit-de-corps, and command climate attempt to describe and

enumerate the phenomenon. To focus on one of the terms, unit cohesion seems to describe the military social support phenomenon that might protect against development of PTSD symptoms the best.

Cohesion can be broken into two components: task cohesion and social cohesion. Task cohesion is a shared commitment among unit members to achieve a common goal, and social cohesion is the extent that group members get along and feel connected to one another.[89] Several studies have found that cohesion has a positive correlation with job satisfaction, discipline, and retention rates among soldiers.[90]

Unit cohesion also has a significant psychological protective effect.[91] A 2007 study found that high levels of task and social cohesion were associated with reduced psychological distress.[92] Another 2007 study found that unit cohesion mitigated the relationship between previous traumatic events and PTSD symptoms. [93] The Mental Health Advisory Team (MHAT) V report endorsed positive social climate and good leadership as a way to reduce negative effects of combat and that they may protect against negative behavioral health problems. Additionally, they found that poor leadership and command climate is associated with increased stress and other mental health symptoms.[94] Along with cohesion, leadership, and positive social climate, perceived combat preparedness has been associated with PTSD. [95]

It can be theorized that the more prepared a soldier believes that he and his unit are, the less the perceived threat and the more the perceived control he will have in combat. It seems clear that increasing a sense of belonging and support in small units can help prevent PTSD.

Education is a fairly straightforward risk mechanism. Socio-cognitive development has been associated with physical health and mental health.[96] The benefits of education generally come from improvement in the socioeconomic status of the individual and can include better employment, wages, quality of life, and a lower incidence of risky behavior such as smoking.[97] It is possible that education also helps develop coping skills directly while indirectly creating a more secure environment resulting from the previously mentioned socioeconomic status benefits. Additionally, low education levels correlate with poorer health and shorter life expectancy than people with higher educational attainment.[98]

Spirituality and/or religion may impact development of PTSD as well. For this paper, spirituality is defined as an individual's core values and beliefs about the meaning and purpose of life, which guide an individual's conduct,[99] and religion is defined as the outward expression of one's faith.[100] This definition can accommodate religious viewpoints along with atheist viewpoints. Several studies suggest that the ability to utilize spirituality and religion following a traumatic may have psychological benefits.[101] In 2005, researchers found that exposure to trauma was associated with an increase in spirituality and that belief systems may be an important part of a person's overall coping strategy for dealing with PTE. [102] Reinforcing existing coping mechanisms or schemas within individuals that can help reconcile traumatic events with their own belief system will likely help reduce incidence of PTSD.

A discussion of spirituality inevitably leads to discussions on morality. It is possible that a moral connection exists with development of PTSD. If a soldier cannot

reconcile a PTE with his moral base, he may experience excess guilt. In *Men Against Fire*, S.L.A. Marshall wrote:

> He [The American soldier] is what his home, his religion, his schooling, and the moral code and ideals of his society have made him. The Army cannot unmake him. It must reckon with the fact that he comes from a civilization in which aggression, connected with the taking of life, is prohibited and unacceptable. The teaching and the ideals of that civilization are against killing, against taking advantage. The fear of aggression has been expressed to him so strongly and absorbed by him so deeply and pervadingly – practically with his mother's milk – that it is part of a normal man's emotional makeup. This is his great handicap when he enters combat. It stays his finger even though he is hardly conscious that it is a restraint upon him.[103]

Medical Corps psychiatrists in the European Theater during WWI found that fear of killing rather than fear of being killed was the leading cause of combat fatigue.[104] Marshall claimed that in WWI only 25% of American soldiers fired their weapons because of this moral conflict.[105] As a result of these findings, the American military began teaching soldiers reflexive firing techniques. These techniques developed muscle memory for engaging enemy soldiers and enabled a much higher rate of weapons firing by the Vietnam War.[106] In 2002, Peter Kilner presented an argument that proposed that teaching reflexive killing without instructing soldiers on the morality of killing in combat can lead to psychological trauma. Without prior moral training, soldiers are forced to reconcile their actions with their moral system after the act and may not be able to move beyond guilt.[107]

Morality may play another role in development of PTSD. The American military is an all volunteer military, but often, the individual soldier does not understand or agree with the policy decision for going to war. The professional soldier does the nations bidding and only expresses his or her disagreements with confidants. It is possible that a

strong belief in the cause for which you are fighting protects against PTSD. Furthermore, the inability to reconcile the war with individual morality and sense of justice may lead to guilt or a lack of locus of control among affected soldiers. It is likely that strong unit cohesion could allow justification to the affected soldier as he is part of a team and will be fighting for his buddies on his left and right, not necessarily for the perceived cause that he doesn't agree with. Current research does not address any possible relationship between belief in the justness of a war and development of PTSD.

Psychological Pretrauma PTSD Risk Factors

Finally, psychological risk factors exist in the pretrauma category worth exploring. Psychological risk factors straddle a gray area between risk indicators and risk mechanisms as effective strategies can be developed to identify those at risk and to provide interventions, which go beyond policy decisions, to prevent development of PTSD upon exposure to PTE. Psychological risk indicators include previous trauma and psychological risk mechanisms include poor mental health, substance abuse, and personality characteristics.

Psychological Pretrauma PTSD Risk Indicators

Repeated exposure to traumatic events increases the likelihood of an individual to develop PTSD as a result of a PTE. Several studies have confirmed the relationship between previous trauma and increased development of PTSD. In 1999, one study found that previous exposure to traumatic events is significantly associated with vulnerability to PTSD on subsequent PTE's. The study found that individuals exposed to two or more

traumatic events involving assaultive violence had five times greater risk of developing PTSD.[108] A subsequent study in 2008 found that cumulative exposure to firefights and traumatic events predicted PTSD and that the development of PTSD increases with each firefight. Among those who have experienced five or more firefights, 19.3% were diagnosed with PTSD; among those who had experienced between three and five firefights, 12.7% were diagnosed with PTSD; 4.5% of those who had not experienced a firefight were diagnosed with PTSD.[109] In the MHAT IV report, increased levels of acute stress were associated with soldiers who had one or more prior deployments.[110] The implication of this linkage to soldiers is enormous. As previously discussed, being deployed to combat exposes soldiers to a wide and unending stream of PTE, from seeing/handling dead bodies, firefights, to mortar/rocket attacks. Experiencing these events may lead to PTSD or add to the likelihood of developing PTSD as a result of the *next* traumatic event.

A 2008 RAND report indicated that the pace of deployments to Iraq and Afghanistan were unprecedented in the history of the all-volunteer force and that the deployments were longer with less of an interval between deployments.[111] The post-Vietnam advent of an all-volunteer force and a post Cold-War drawdown resulted in a smaller expeditionary military, which was adapted to an increased operational tempo (OPTEMPO) caused by simultaneously fighting two prolonged wars.[112] Although it is difficult to compare previous wars to each other due to the extreme uniqueness and complexity of each one, it is helpful to understand the potential impact of an all volunteer force on PTSD to compare the numbers of troops engaged in each war as a percentage of U.S. population. Approximately 16.1 million U.S. troops (approximately 9% of U.S.

population) served in WWII over nearly four years of fighting, 5.7 million (approximately 3.5% of U.S. population) in Korea over three years of fighting, 2.5 million (approximately 1.1% of U.S. population) in Vietnam over 10 years of fighting, and ~1.4 million (approximately 0.4% of the U.S. population) has served in OIF/OEF/OND spanning over 11 years and counting.[113,114,115,116]

As mentioned earlier, the reduced force pool had an impact on soldiers. It necessitated multiple deployments for soldiers, which led to a decrease in the time a soldier remained home with their family between deployments (Dwell time). The force structure also grew significantly in the Army to try to accommodate the required deployed strength, which resulted in a reduction in screening criteria for enlistment and faster promotion rates.[117]

Additionally, a 360-degree battlefield with no defined front line exposed every deployed soldier to violence traditionally only experienced by soldiers "in the trenches" and contributed to a highly ambiguous environment. The missions executed by soldiers in OIF, OEF, and OND were also distinctly different from previous conflicts; a military unit could transition from kinetic counter-insurgency operations to humanitarian assistance missions from one day to the next.[118]

The effects of all of these contributing factors and the potential counterbalance of the ability of a citizen to volunteer to join or a soldier to decline to reenlist make studying the effect of a smaller all-volunteer force extremely difficult. Because the current U.S. force is an all-volunteer force, the overall force is more professional and more committed because of the freedom to decide to serve or not. Conversely, because the all-volunteer force is small, more is being asked out of a few.

While the landscape has changed since 2008 with fewer soldiers in combat and an announced end to combat missions on the horizon in 2014 for Afghanistan, the reality is that the U.S. currently has a generation of all-volunteer soldiers who have multiple combat deployments and all of the associated trauma experiences that were experienced during them.

Previous wars were not fought with an all-volunteer force and were able to spread trauma exposure among a much larger pool. The repercussions of this compounded trauma are just beginning to make themselves clear; in spite of enormous efforts to prevent suicide, 349 active-duty troops killed themselves in 2012.[119] These numbers do not include discharged veterans, or reserve figures; the Department of Veterans Affairs estimates that a veteran commits suicide once every 80 minutes, and the trend may be getting worse.[120]

Additionally, and potentially more of a factor for national security, is the fact that any near-future conflicts will draw from the same all-volunteer force pool that carries the already large burden of traumatic experiences from OIF/OEF/OND with them. The duration between conflicts and or deployments may be an important mitigating factor for soldiers who have been exposed. A 2012 study found that longer dwell times, or times at home away from combat, are associated with a lower risk for development of PTSD.[121] This could mean that a several year gap between wars would help negate the compounded effects of previous combat trauma on individual soldiers' mental health. How long the gap needs to be between combat exposures is a question that needs more attention.

Psychological Pretrauma PTSD Risk Mechanisms

Another psychological risk for development of PTSD is poor mental health. Poor mental health prior to combat exposure and trauma exposure has been associated with an increased risk for developing PTSD. Results of the Millennium Cohort Study found that participants who scored below the 15th centile for mental health accounted for 35% of the incidence of PTSD following a combat deployment.[122] It is possible that poor pretrauma mental health increases the likelihood of developing PTSD after exposure to a PTE by affecting an individuals peritrauma cognitive processing of an event and posttrauma coping strategies. Through screening prior to admitting to military service and by subsequent periodic screening, those suffering form poor mental health may be identified and either denied entry into military service, or targeted for treatment.

Substance abuse may also increase the likelihood of developing PTSD. The active mechanisms for increasing risk of PTSD could be decreased social support, lower socio economic status, or possibly due to chemical alterations caused in the HPA of the brain. Alcohol can increase cortisol levels in chronic drinkers, which may lead to sleep disruptions, cognitive deficits, mood disturbances, and other stress related disorders.[123] The implications for military prevention efforts are straightforward: screen for substance abuse, remediation or separation of those abusing, and education for the general military population. The military already has a robust substance abuse program in place to combat the problem within the force. PTSD prevention efforts could rely heavily on this program to achieve greater results.

Finally, individual personality characteristics might also predict development of PTSD. Personality characteristics that may predict PTSD are difficult to study partly

because there is no concrete, agreed upon definition of what a personality trait or characteristic is, and partly because they rely on either retrospective studies conducted after a person develops PTSD or prospective studies where a person may or may not be exposed to a PTE.

For this paper, the Personality Psychopathology Five (PSY-5) personality index are used and every attempt will be made to translate other personality characteristics into the PSY-5 schema. [124] Personality characteristics that lead to pathology can generally be broken into five categories, known as the PSY-5: Aggressiveness, Psychoticism, Constraint, Negative Emotionality/Neuroticism, and Extraversion/Positive Emotionality.[125] The aggressiveness category is focused on offensive aggressive behaviors, including intimidation. Psychoticism is focused on perceptions/misperceptions of reality including feelings of alienation and unrealistic expectations of harm. Constraint involves control and on extreme ends of the spectrum can be characterized by impulsiveness (obsessive-compulsive personality disorder), and risk aversion (antisocial personality disorder). Negative Emotionality/ Neuroticism involves feelings of shame, increased self-criticism, increased anxiety/worry, and negative emotions. Extraversion/Positive Emotionality involves seeking and enjoying social experiences, feeling joy, and engaged in life's tasks.[126] People at the extremes of any of the five categories are more likely to have a psychological abnormality. The instrument used to assess these characteristics is the Minnesota Multiphasic Personality Inventory (MMPI).[127]

Several studies have shown correlation between Negative Emotionality/ Neuroticism and development of PTSD.[128,129] In 1993, one study utilized MMPI scores

collected during college prior to combat service to study Vietnam Veterans in an attempt to determine if any personality characteristics could predict lifetime PTSD. Results suggested that veterans who are more inhibited and withdrawn, and are less happy might be at greater risk for developing combat related PTSD.[130] While not in PSY-5 terms, the correlation between inhibition, withdrawn and unhappiness with Negative Emotionality/ Neuroticism is apparent. In 2000, a separate study confirmed the 1993 study findings, and concluded that the number of stressors during deployments was the most important predictor of PTSD followed by the personality traits negativism and psychopathology.[131] Additional support for the role of personality traits in development of PTSD can be found in a subsequent study in 2005. Researchers studied a group of firefighters and found that a high-level of hostility and a lower level of self-efficacy accounted for 42% of the variance in PTSD symptoms after two years.[132] Translating these terms into a PSY-5 construct, the term, 'hostility', is related to 'Aggressiveness' and the construct of 'low self–efficacy' is associated with 'Negative Emotionality/ Neuroticism'.

It appears that personality characteristics play a role in the individual appraisal of events; meaning that a person with extremely negative views and a lack of confidence in their ability to handle the situation would view a PTE much differently than a person with positive emotionality and high self-confidence.[133,134] One of the most prominent frameworks for personality, the Five Factor Model for personality traits views personality traits as biologically based components that are relatively unaffected by the environment, stable across the span of adult life and form the core of the personality.[135,136] More research is needed on intervention techniques for assisting those with at-risk personality characteristics. The implication, if the Five Factor Model is correct, and personality is

stable across a lifetime, is that personality based interventions would be ineffective at changing personality traits and should focus on giving those at risk the tools required to adequately process PTE.

SUMMARY AND SUGGESTED FUTURE RESEARCH

Not everyone who experiences a traumatic event develops PTSD. There are pretrauma biological, psychological, and social risk factors that can predict and potentially mitigate development of PTSD. Pretrauma risk indicators include genetics, age, gender, rank, war support, and previous trauma experience. For some of these risk indicators, policy based decisions could be made which would reduce future PTSD incidence. Pretrauma risk mechanisms include biochemical functioning, medical health, family support, military support, education, spirituality, morality, mental health, substance abuse, and personality characteristics. Interventions can be developed to address these risk mechanisms to build resilience and increase future combat effectiveness.

More research is needed on many of these areas to appropriately determine strategies and to develop an efficacious PTSD prevention program. Specifically of interest to future PTSD prevention research is the role of belief systems in the development of PTSD. Does a strong belief in the cause for which combatants are fighting influence development of PTSD? As it is likely that most non-governmental organization (NGO) personnel in combat zones have a strong belief in their cause, it would be interesting to examine the PTSD rate for NGO personnel in combat zones for comparison purposes. Most U.S. military services have instituted resilience based

programs to identify and prevent psychological casualties. These programs are beyond the scope of this paper, but future research should critically review these programs to determine comprehensiveness and effectiveness. A PTSD prevention program should not necessarily follow the medical model of correcting deficiencies; rather it should focus on building resiliency and advising policy makers. Additionally, future studies should examine the impact of implementing policies relating to risk indicators for mental health problems would have. For example, assuming a genetic marker existed for predisposition for developing PTSD, what would the consequences be of denying entry into the military for screening positive?

CONCLUSION

Nearly 2,500 years ago, Xenophon wrote, "I am sure that not numbers or strength bring victory in war; but whichever army goes into battle stronger in its soul."[137] Xenophon knew that mental health in combat was required for victory. PTSD dramatically reduces combat effectiveness of soldiers affected and reduces the combat capability of a fighting force. The social and fiscal costs associated with PTSD treatment are heavy, but not as expensive as a hollow military force without the will or ability to fight. It is for these reasons that a paradigm shift from posttrauma PTSD treatment to pretrauma PTSD prevention is required. Any conflict in the next 20 years will be likely be fought with the same small, all-volunteer force that has experienced multiple traumas during more than 10 years of war. This force is at a greater risk for developing PTSD as a result of the *next* traumatic event than any other cohort. Biological psychological and social pretrauma risk indicators and risk mechanisms can be leveraged to form policy

decisions and to develop a comprehensive PTSD prevention effort within the military. In addition to preserving combat power, this paradigm shift will achieve long-term healthcare savings by reducing the number of veterans on disability and receiving care for PTSD.

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